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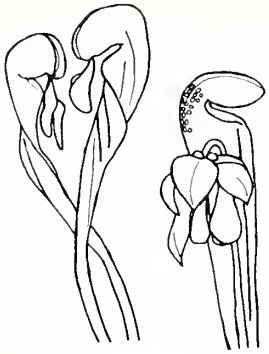
# CARNIVOROUS PLANT NEWSLETTER

VOLUME 8, Number 4 DECEMBER, 1979



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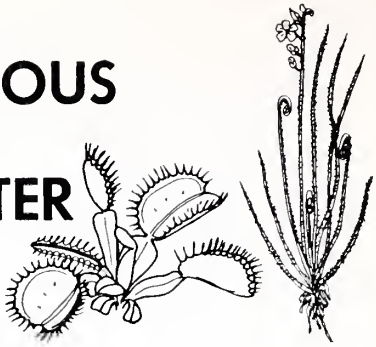

Volume 8, Number 4
December, 1979

## Cover

*Sarracenia* x *harperi,* a naturally occurring hybrid between *S. flava* and *S. minor.* The throat patch from *S. flava* is barely discernable while the hood shows some of the characteristics of *S. minor.*

Photo by J. Mazrimas

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your subscription to CPN:

All correspondence regarding subscriptions, address changes and missing issues should be sent to Kathy Fine, c/o The Fullerton Arboretum, Dept. of Biology, California State University, Fullerton, CA 92634. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to CSUF FOUNDATION — ARBORETUM.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

Copy deadline for the March issue is February 1, 1980.

CO-EDITORS:
D. E. Schnell, Rt. 4, Box 275B, Statesville, NC 28677
J. A. Mazrimas, 329 Helen Way, Livermore, CA 94550
T. L. Mellichamp, Dept. of Biology, UNCC, Charlotte, NC 28223
Leo Song, Dept. of Biology, California State University, Fullerton, CA 92634

SECRETARY-TREASURER: Kathy Fine, c/o The Fullerton Arboretum

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# Editor's Corner

With this issue, we end another very successful year and look forward to the New Year. We hope that our readers have found CPN interesting as well as informative. We would like to remind you that much of the material found in CPN comes from our readers, and that we welcome any contributions.

Due to the difference in postal rates for mailings overseas, we regret that it is necessary to raise subscription rates for areas other than the U.S., Canada and Mexico to U.S. $9.00, effective with new subscriptions for Volume 9. Multiple year subscriptions already paid at the old rate will be honored.

A look at the subscription breakdown shows that we need to retain our present group of subscribers in addition to attracting new ones for the coming years. We hope that, in addition to renewing, everyone will do his or her part to spread the good word about CPN. Students, for example, could encourage their school libraries to subscribe, thereby making CPN available to a wider group of readers. Those becoming acquainted with CPN through a library might then subscribe in order to have their own copies.

Pat Hansen, our most capable secretary/treasurer, will be leaving us at the end of this year due to her husband's transfer to Mexico. We will miss her and wish them well. Our new secretary/treasurer, Kathy Fine, will begin with the March, 1980 issue. Correspondence regarding subscriptions, address changes and missing issues should be addressed to her: Kathy Fine; CPN; The Fullerton Arboretum; CSUF; Fullerton, CA 92634.

# Seed Bank

Patrick Dwyer (St. Michael's Episcopal Church, 49 Killean Park, Albany, NY 12205) reports on the Seed Bank:

As of October 20, we have answered 341 letters this year. Keep the seed coming in. We really are interested in obtaining cuttings of *Heliamphora* from anyone who has extra. Thank you again for everyone's support!

October 10, 1979
Cost $0.50 per packet

*Byblis liniflora; Darlingtonia californica; Dionaea muscipula; Drosera aliciae* (5), *D. aliciae* (pale fl.), *D. anglica, D. arcturi, D. auriculata, D. burkeana* (4), *D. burmannii, D.* x *californica* (2), *D. capensis, D. capensis* (narrow fl.), *D. capensis* mix, *D. capillaris, D. capillaris* (long lf.), *D. capillaris* (white fl.), *D. capillaris* mix, *D. erythrorhiza, D. filiformis, D. intermedia, D. linearis* (10), *D. linearis* x *rotundifolia* (10), *D. montana* (5), *D. montana* (white fl.), *D. peltata, D. pulchella* (2), *D. rotundifolia, D. rotundifolia* (Oregon), *D. spathulata, D. spath.* (Australian), *D. spath.* (Kansai), *D. spath.* (Kanto), *D. spath.* (white fl.), *D. whittakeri, D. sp.* (U.S. mix); *Drosophyllum lusitanicum; Nepenthes ampullaria* (Borneo), *N. rafflesiana* (Singapore), *N. mirabilis* (Queensland) (10), *N. villosa; Pinguicula alpina* (12), *P. grandiflora f. pallida* (2), *P. ionantha* (15), *P. lutea* (15), *P. planifolia* (12), *P. vulgaris* (15), *P. vulgaris* bicolor (4); *Sarracenia alata* (2), *S. alata* (x-ray) (5), *S. flava, S. flava* (Gulf), *S. flava* (Gulf — hvy vein), *S. flava* (Gulf yellow/hvy vein mix), *S. leucophylla, S. minor, S. psittacina* (3), *S. psittacina* (Gulf) (5), *S. purpurea, S. purpurea purpurea, S. purpurea venosa, S. purpurea venosa* (pink fl.), *S. rubra* (5), *S. rubra* (Gulf), *S. rubra alabamensis, S. rubra jonesii, S. rubra* (possibly *wherryi*) (3), *S. alata* x *leuco.?, S. alata* (purple th.) x *leuco.* (6), *S. alata* x *oreo., S. alata* x *purp.* x *rubra?* (1), *S. alata* x *rubra* $F_2$, *S. flava* x

(Please turn to page 115)

# News and Views

ARIC BENDORF (1103 Creekside Way, Ojai, CA 93023) writes: I will be travelling in the Orient during August/September and will stop in Malaysia and the Philippines to collect *Nepenthes*. I will be going to Kuching, Kota Kinabalu in Borneo and Luzon and Mindanao in the Philippines. Although I can't definitely say which species I will be able to collect, I expect to gather the Kinabalu varieties, *N. veitchii, northiana, bicalcarata,* etc., from Sarawak and *N. merrilliana, mirabilis, truncata, petiolata, globamphora, belli* and any others from the Philippines. I will be offering seed and hopefully some plants for trade and sale when I return. Anyone interested could write me at the above address and please include SASE for replies.

BILL CARROLL (Botany Dept., Carolina Biological Supply, Burlington, NC 27215): Here are several photos which may be of interest to CP growers. Two pertain to perhaps the worst pest of pitcher plants. The larvae shown, and the resulting moth, used to infest our plant beds every year.

Two years ago, I tried soaking the rhizomes in Orthene® (a systemic insecticide) overnight. The leaves are first cut off and the rhizomes thoroughly rinsed before replanting. There's been no sign of the pest since!

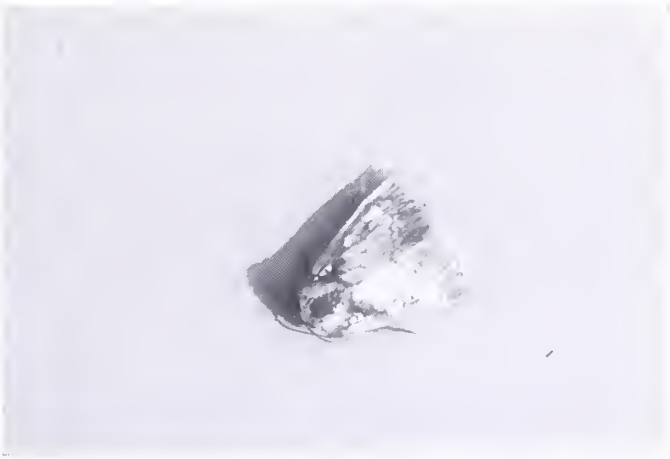
Another slide shows the "catch" of a *Sarracenia flava* leaf. This picture was taken at the N.C. Botanical Garden several years ago.

The *S. flava* seedlings are in the CBS greenhouse, growing well in the same soil mix and Miracid© fertilizer program I developed for *Pinguicula lutea* (CPN 8:58-9). Small "net" pots fit into a plastic holding tray which keeps the roots restricted. Commercial growers may be able to get a free sample by writing: Growing Systems, Inc., 2950 N. Weil St., Milwaukee, WI 53212. I hope this information will be useful to you and especially to the commercial CP grower. I assume the larvae mentioned above is *Papaipema appassionata.* (*Yes. DES*)

"Catch of *S. flava* leaf" in North Carolina Botanical Garden.
Photo by Bill Carroll

WALTER L. GREENWOOD (1838 Menold Court, Allison Park, PA 15101) announces the formation of the SOCIETY FOR THE PROTECTION AND NURTURE OF CARNIVOROUS PLANTS in western Pennsylvania (SPNCP). All interested individuals in the broadly contiguous area may obtain information by sending a stamped self-addressed envelope to Mr. Greenwood at the above address.

Mr. Greenwood also has an excess of large (¾" - 1½" pitchers) *Cephalotus*



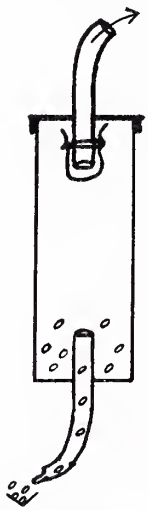
*Papaipema appassionata* moth. Photo by Bill Carroll.

Damage to *S. flava*. Photo by Bill Carroll

*S. flava* seedlings in soil mix fed with Miracid® fertilizer. Photo by Bill Carroll

plants for sale. Those who are interested should contact him at his address for prices and other details. Enclose a self-addressed, stamped envelope for replies.

ANDRE HORVATH (69 Pringle Ave., Belrose, NSW, AUSTRALIA 2085) writes: I have some information here for readers of C.P.N. It will help with the collecting of gemmae from Pygmy Droseras. I call it a *gemmae extractor*. A great number of gemmae can be collected in a matter of a minute or so and it can also be used for harvesting small seed and other things.



This is what you will need to make one: One small plastic bottle with a tight fitting top (pill bottle) 1″ x 3″ x 12″ of clear plastic hose (normally used in fishtanks), an airhose joiner, rubberband and a square inch of fine netting (material from a fish net).

Drill two holes, one at each end of the bottle and make the holes small enough so that the plastic hose will make a tight fit. Glue the tubing to make sure it's airtight. Attach netting to one hose end with a rubberband and on the end of the other hose, fit the airhose joiner about halfway. This will make the hole smaller, making air drag stronger. By using your mouth, suck at the top end of the hose while holding the other end over a pygmy Drosera and gemmae will be collected in the bottle or tube. If they are wet, they can be removed by washing or blowing water through the tube. Seeds can also be collected in a similar way if the container is kept dry.

In order to grow the gemmae, dilute them with water and pour them over a surface of peatmoss.

JOHN HUMMER, (1705 N. Quebec St., Arlington, VA 22207). I had some plant lice (mealy bug-type) on the roots of *Sarracenia purpurea*. The source of these bugs was evidently in the sphagnum moss which was harvested from a nearby bog and so other CPNers ought to beware of this source of infection. I used a Malathion solution to kill these cottony lice and it did so efficiently and with no damage to the plant. There is no bigger problem with tender plants than those cottony lice eating away at the roots. I'm glad to get rid of them.

JOE MAZRIMAS reports that there was an excellent response from CP growers in the recent San Francisco Flower Show in August. About a dozen growers submitted 55 plants which were the hit of the entire show. The best plant in the show was grown by Chester Nave and he won a beautiful blue ribbon for a healthy and robust specimen of *Sarracenia* x *chelsonii*. A special thanks to Anthony Rea for the splendid work he did in setting up the display of plants. The winners of the show were: Mike and Paul Morris, Joe Mazrimas, Antonio Brito, Anthony Rea, Geoffrey Wong, Robert Allen, Chester Nave, Eileen Masterson, Larry Logoteta, Allan Ber, C. Norris and Byron Aarstead. The next show will take place in Oakland about May, 1980. See you there!

JIM MILLER (2319 Ninth St., Green Bay, WI 54304) writes: After completing my Report on the Status of Gulf

San Francisco Flower Show, August 1979.
Best of Show: *S. x chelsonii,* grown by
Chester Nave.
Photo by J. Mazrimas

San Francisco Flower Show, August 1979.
Terrarium Prize: Geoffrey Wong.
Photo by J. Mazrimas

Coast Carnivorous Plants, I had an opportunity to revisit many of these locations with Bob Hanrahan this past August.

I was particularly interested in the area some 45 miles north of Mobile, Alabama where I had found so many species and hybrids. Due to the heat and lack of rain, most of these spots were extremely dry and pitchers of many of the Sarracenias were dying back. The plant I was most interested in seeing again was a short, stocky form of *S. alata* which here grows only to about 45cm. These plants are typically green or a light tan to copper color with little venation. But the real difference is that these plants are noticeably pubescent. Even the hybrids of this plant with others in the area (*S. leucophylla, purpurea* and *rubra*) display the pubescent pitchers.

These plants are easily distinguishable in my greenhouse from the other forms of *S. alata* because of this characteristic. I have not had the opportunity to observe this plant in flower in the field so I cannot note if there are any floral differences. The plants in my greenhouse did not flower this year as a result of my move to Green Bay, Wisconsin. However, I strongly feel there is no introgressive hybridization causing this morphological change and that the plant deserves a formal varietal status such as *Sarracenia alata* var. *pubescens.*

I would be interested in corresponding or discussing this plant with others who have seen it in the field. This particular area of the state seems to be undergoing changes in the populations of many of the Sarracenias due to the vast amount of hybridization in the field as well as various local conditioning which can affect these plants. There are several forms of *S. rubra* in this region as well, displaying differences from the typical "gulf" varieties. Certainly more study of this area is in order.

I have heard and read of the experiences of other growers concerning *Sarracenia oreophila.* Basically, these persons noted early winter phyllodia as well as leaf browning and drying as early as August. These are carry-overs from the plant's native environment. On August 23rd of 1978 I visited one such habitat and found the majority of the plants here were in various stages of leaf deterioration and all had the typical curved winter leaves present.

My experience with these plants varies in that this year, in their second season of cultivation, the plants formed phyllodia as early as July here in the cool Wisconsin growing conditions. This was followed in several weeks by the production of large robust, but somewhat curved pitchers. There was also a noticeable increase in venation in these leaves. Only one of the seven plants failed to produce these pitchers. They are grown side-by-side with other southeast Sarracenias. Only now, in mid-September with nighttime temperatures dipping into the forties, have these plants stopped producing pitchers.

During my recent move from Tallahassee, Florida to Green Bay, Wisconsin, my CP were packaged for shipping and left during transit and in storage for over three weeks. As imagined, this is quite a while for these light-loving plants and unfortunately, many fared poorly even though care was taken to treat plants with a fungicide and potting mediums were just damp.

The Sarracenias survived with only a minimum of damage such as mildewing of the leaves. Many *Drosera* reacted poorly with some (*linearis, anglica, filiformis*) going into dormancy or succumbing to fungus. All forms of *D. binata* and *capensis* lost their leaves to rot but have begun to recover their former strength and growth. My *Nepenthes* seemed remarkably unbothered and my Darlingtonias showed new growth.

But the biggest surprise came with the Pinguiculas. Though a few (*pumila* especially) rotted, the rest looked remarkably healthy. As an experiment, I decided to grow a few plants in low light levels. The results were interesting.

I should point out here that I have grown almost all my butterworts for the last year or so in shady conditions in pots covered over with plastic cups to increase humidity and with the soils just damp.

I placed two plants each of *P. ionantha* and *planifolia* in just damp moss in plastic bags and left them for two months in my basement where the only light came from two small windows. At the end of the test period the plants were removed and inspected. The results were large well-developed leaves with a healthy green coloration. One plant of each was then removed and placed in a shady spot in my greenhouse where they proceeded to do poorly. The basement plants continue their remarkable growth.

It is certainly too soon to reach conclusions as to the significance of this experiment but I will continue to monitor these plants and their future development.

The conditions created in my basement were actually close to the conditions in which many of the European and Mexican Pinguiculas are found. *P. macroceras* in California may be found growing in deep shade near Gasquet, sometimes actually growing upside down on the undersides of rock formations in cracks and crevices. Perhaps these observations indicate that our southeastern Pinguiculas grow in a habitat of full sun not because of preference but because of some other environmental factors such as decreased competition from other plants or because frequent wet periods would cause rot under lower light levels.

Again, this proves how much more study these remarkable plants deserve to fully understand their relationships to the environment.

RICHARD ROBINS (School of Biological Sciences, University of East Anglia, Norwich NR4 7TJ, England) has come up with an idea to confront a problem we all have: building our files of CP literature reprints. He would like to work out an exchange basis for reprints (originals preferably, copies if supply exhausted). He would appreciate all authors of CP papers sending him reprints or copies (theses also) for which he in turn would send back his papers as they appear. Mutual agreement beforehand could cover postage on larger items or large packets of papers. Besides initial exchanges, the concept would then be continuous in that each individual in the growing network would establish a growing list of people to whom he would send reprints of his papers as they appeared and from whom he could expect reprints of their papers. If you have reprints of your published papers or would be willing to make Xerox copies if original supplies are exhausted and wish to begin this exchange and file buildup with Richard, write him at the above address.

STEVE SMITH, (RD #1, Box 296, Kirkwood, New York 13795) On July 19, 1979 my wife and I went to the Green Swamp in North Carolina. This is a trip we have made at least once a year for the past four years. This year was full of surprises. The first surprise was finding the drainage ditches, usually with one to two feet of water in them, dry with cracked soil bottoms. This was due to a drought during the early summer and gave us easy access to the opposite bank. Here we found *Sarracenia* which were usually loaded with pitchers at this time of year but now were bare except for flower stalks. Some plants were able to send up two or three pitchers but they were small compared to pitchers from previous years. One exception was a *S. flava* plant that was growing next to a tree. This plant had one large trap approximately 3.5 feet (1 meter) tall.

# Short Notes

## *Sarracenia* Species in Australia

by Steve Clemesha
(C1 — P.O. Moonee Beach, NSW 2450, Australia)

In Eastern Australia — near Coffs Harbour and at Sydney, Sarracenias can be grown out of doors all year as the climate is basically similar to that of southeastern U.S.A. except summers and winters are much less extreme. The plants do well in full sun or light shade for part of the day. The climate near the coast is decidedly sub-tropical and extremes of temperature are rare, with frosts occurring only in the low-lying land.

Here, winter is the shortest season and summer the longest. Sarracenias have shown themselves to be rigid and uncompromising in a different environment. They flower a little earlier than they do in Sydney and grow a nice crop of spring leaves but towards the end of summer they become scruffy and untidy which means they are ready for a winter rest that will not arrive for a few more months.

*S. leucophylla* grows much larger here in the warm sun than it did in Sydney. *S. alata* and *S. flava* perform at least as well but some clones of the latter plant flower well and others never have, either here or in Sydney. *S. oreophila* produces spring pitchers and is at its peak in November. In summer, the flat leaves replace the pitchers probably in preparation for the hot, drying winds it gets in its native habitat but that does not occur here and this characteristic is very clearly genetically fixed.

*S. minor* and *S. psittacina* both do well here and in particular the giant form of *S. minor* does particularly well. Both species slow down in growth in late summer which may reflect their adaptation to a shorter season. *S. purpurea* ssp. *venosa* also does well and has shown a greater degree of adaptation than most species or perhaps its longer lasting pitchers give this effect. The typical subspecies makes a lot of pitchers which are mostly small and it seldom flowers for me. It is very easy to grow provided it is protected from wind.

Meanwhile, *S. rubra,* the tall Gulf Coast variety, grows well and is attractive most of the year. The subspecies *alabamensis* and *wherryi* grow well in spring and then become semi-dormant. The short typical form tends to rot off and I am trying them in shallower water trays and deeper pots. *S. rubra* ssp. *jonesii* does very well considering its cool mountain habitat. Most years it will flower but not as freely as it should.

In Australia when I was building up my *Sarracenia* collection in the 1960's it was (and still is) very difficult because of the extreme difficulty of importing plants into Australia. Because of this, I aimed primarily at importing all the species as I felt I could make the hybrids myself. Eventually I got all the species and by the time I had the last ones I also had some of the primary hybrids. I then set out to complete my set of them.

I use a different pollinating technique from most. I do not use a brush but instead rub the "umbrella" where the pollen collects with my finger then rub this onto the stigmas. I then clean my finger on sphagnum and dry it thoroughly before making a second cross. I can make ten crosses at a time without using the same finger twice.

Problems arise in crossing species that do not flower together. I overcome this

by storing pollen. Flowers must be watched soon after opening; as soon as the pollen begins to fall and before the masses break up, the pot can be held partly on its side, the lowest petal lifted and the flower gently tapped so that the pollen falls onto a piece of paper held underneath. This can then be folded up with the pollen inside and stored in the refrigerator until needed. I have crossed my first flowering species (*flava*) with a *psittacina* that flowered six weeks after collection of pollen with success.

I remove the pollen from the paper with my finger and find this is a much more efficient way of pollinating than a brush and it is especially valuable when pollen is limited.

In collecting pollen, it is much easier to do it just after it falls, before the masses break up. Extreme care must be taken if one also wishes to use the plant you are collecting pollen from as a female parent — not to break the tender stem or to self pollinate it. With care it can be done and I have used plants I have collected pollen from as female parents many times and always got the result I wanted.

The next difficulty I ran into involved *S. minor*. I tried to cross it with various species using both fresh and stored pollen. I primarily used it as a female parent because of its late flowering habit. The result was empty capsules. So, the answer was obvious — use it as a male parent. This I tried and all went well. I have never flowered *S. flava* late enough to do this but did not try as one hybrid I imported was *S. harperi*. I since have made this cross using the giant form of *S. minor* from Lake Okefenokee as the female parent and it has been a bit more successful. *S. psittacina* is not a good seed parent either, but in my experience it was more successful than *S. minor*.

Many of the hybrids I made are well known and occur naturally in the U.S.A., e.g., *S. alata* x *purpurea, S. purpurea* x *minor* and *S. rubra* x *purpurea* but I also made the ones that do not occur naturally because of geographical isolation or other reasons.

One of these is *S. psittacina* x *flava*. This cross is a slow grower for me and gets a bit bigger each year. The pitchers are like most *psittacina* hybrids but are more open and the plants make their main growth in spring.

I expected big things of *S. leucophylla* x *minor* (*S.* x *excellens*), but am a bit disappointed they are not as colourful as I expected and tend to be too dark. I will try it again with a paler *leucophylla*.

The only all-yellow hybrid that occurs naturally is *S.* x *harperi* — *flava* x *minor* — and this is the only one I have not made and raised.

For me, not all plants of *S. flava* flower and I have some clones I have never flowered in ten and more years, but a friend flowered a seedling from the same batch for a few years before the plant died. I made a cross between this — from borrowed pollen — and *S. oreophila*. The result is very *flava*-like and very tall — over a metre high and one of the giants of my collection while they are at their best in spring.

Most of my *flava* crosses are with the heavily veined form which flowers well here. Recently "copper top" and the form with red pitchers and a green lid with red veins have started to flower and are being used with high hopes.

*S. alata* x *flava* is a good cross. Its pitchers are about intermediate between the two and they grow right through the summer. They do not have a tendency to get poor as the season progresses.

*S. alata* x *minor* is like a pale *rubra* x *minor* and not very outstanding or vigorous.

I crossed *S. oreophila* with all other species and expected a result almost indistinguishable from the same crosses with *flava* but this was not the case.

*S. flava* x *oreophila* is very *flava*-like with flat leaves intermediate in shape. Some are very red for a short period in

spring but most pitchers are very like the *flava* parent.

*S. oreophila* x *alata* is quite unlike *flava* x *alata*. It is short growing and pale. (I used the green *alata* as I did not have the purple throat variety then.) It is rather like a small *alata* but goes to flat leaves and poor pitchers in mid-summer. Its only advantage is it flowered young and allowed me to make a cross with *S. harperi*, thus giving a hybrid with the four yellows. The only surviving plant is half grown and looks very *alata*-like.

When I made *S. oreophila* x *minor* I thought I would get a *harperi*-like plant. Such is not the case. It makes short, remarkably stout pitchers only a bit taller than *minor*. It is quite well veined and is a desirable plant to own. It slows down in late summer but makes no flat leaves.

The first *oreophila* hybrid I raised was with *S. leucophylla*. Its seed ripened during a very wet autumn and some seed was germinating in the ovary when I opened it. These were planted and grew very vigorously. This is a very strong and vigorous hybrid. The pitchers are a dark brownish colour. It makes a set in spring then in summer produces a good crop of erect flat leaves. These develop later than in *oreophila*. As the season draws to an end it produces a set of good strong tall pitchers as does *leucophylla* but not x *mooreana*. Its flowers are very large and of typical colour for a cross between a red and yellow.

*S. oreophila* x *purpurea* is interesting and beautiful. I used *purpurea venosa* in all hybrids as the typical subspecies seldom flowers in my subtropical climate. The plants are smaller and more compact than my one clone of *S.* x *catesbaei* and are glossy and waxy and very nicely coloured (*purpurea* colours.) The hood shape is quite different to the *flava* cross.

Due to a series of misfortunes I only raised one *S. rubra* x *oreophila* which now is mature. It is erect and shows no tendency to produce flat leaves. It is a good red and the pitchers are thick in texture. The plant is the result of a cross between *oreophila* and a small form of *S. rubra* from Carolina. The result is as tall as *oreophila* but more slender and erect.

Last and least of the *oreophila* hybrids is x *psittacina*. It is a disastrous cross with me. It makes a crop of pitchers in spring which are not as good as those of *alata* x *psittacina* or even *flava* x *psittacina* and in mid-summer these half die back as they do with *oreophila*, but with no flat leaves to replace them. *S. flava* x *psittacina* does not do this — it simply slows down. *S. alata* x *psittacina* is the best cross of this type. Although *oreophila* x *psittacina* stays alive from year to year, it never gets very big and does not flower.

I now am repeating a lot of hybrids made earlier using better parents — i.e. the giant *minor* and red throat *S. alata*.

I have made some second generation hybrids, e.g., (*alata* x *psitacina*) x (*flava* x *purpurea*). They produce unusual shaped pitchers for a brief period of the year but most of the time are poor and scrappy. *S. mitchelliana* (*leucophylla* x *purpurea*) x *ahlesii* (*alata* x *rubra*) is very weak and poor despite having two vigorous parents.

I am finding that hybrids between four unrelated species give weak progeny and often the pitchers are very plain and uninteresting.

The most attractive second + generation hybrids I have are *wrigleyana* = (*leucophylla* x *psittacina*) x *minor*. This produces very attractive erect pitchers for an all too short period in summer. When at its peak it is one of the best Sarracenias.

*S.* x *excellens* (*leucophylla* x *minor*) x (*leucophylla* x *psittacina*) is a cross of which I have two seedlings. They are building up slowly. I hold high hopes for this cross. All pitchers are erect and white with some veining. They are paler than is desirable but possibly this could

(Please turn to page 114)

*S. leucophylla* x *S. flava*

Photo by Rob Gardner

# north carolina botanical garden

**chapel hill, 27514**

by Rob Gardner*

In the arresting humidity of the North Carolina noonday sun you stop to wipe the perspiration from your face. Your searching eye reveals the object of your search: partly concealed among the low grasses is a particularly fine clump of the native red pitcher plant, *Sarracenia rubra.* Closer examination of the nearby area turns up *Drosera capillaris, D. filiformis,* a scattered *S. purpurea* or two, several *Dionaea,* and then suddenly a whole patch of *Dionaea,* with unusually large, crimson-lined traps. In this same area you will eventually discover *S. minor, S. flava* in all its color forms, the rare pink-petaled form of *S. purpurea venosa* and much more. Are you, you wonder, in the great Green Swamp, located in the extreme SE corner of North Carolina? No, actually you are at the North Carolina Botanical Garden (NCBG) located in the center of the state in Chapel Hill.

This unique garden of native North Carolina and Southeastern U.S. plants, under the direction of Dr. C. R. Bell, is a living museum of plant material representing some of the major regions of N. C. organized and planted on a habitat concept. The visitor can stroll from a cool and shady representative planting of the Southern Appalachian Mountains directly to a much more open reconstruction of Coastal Plain savannahs studded with terrestrial orchids and all kinds of *Utricularia, Drosera, Sarracenia* and *Dionaea.* Adjacent to the coastal plant collection is a Sandhills region exhibit, characterized by long leaf pine, turkey oak, and wire grass. This collection also has its share of CP planted in the moist, low sphagnum mounds. The Piedmont region, located between the mountains and the coastal plain, is well represented by a nature trail system through much of the Garden's 307 acres.

Associated with the Botany Dept. of the Univ. of North Carolina, NCBG is a living outdoor classroom offering various programs in natural science for grammar school children as well as adults interested in botany and horticulture. The Garden also provides research opportunities for botany and zoology graduate students and faculty.

Much of the energy expended at NCBG is invested in developing, promoting, and practicing an environmentally sound plant conservation and preservation ethic. NCBG regularly cooperates with the Nature Conservancy, the N. C. Wildflower Preservation Society, the Tennessee Native Plant Society, the Audubon Society, the N. C. Division of State Parks, and many other conservation-minded groups. The Garden is deeply committed to its conservation role through its many programs, lectures, workshops, tours, and other activities presented to a wide variety of groups. Under the personal guidance of Supt. Ken Moore, the NCBG staff practice an on-going program dedicated to discovering new and more efficient ways of propagating from seed, division, and cuttings, a multitude of our showy native plants worthy of consideration by the avid home gardener. We are particularly involved in efforts to learn

*Staff gardener and curator of CP

to propagate as many of the rare, endangered, and less common species, including CP's. At the same time the showy and easy to grow native wildflowers are being promoted, the Garden points out the great damage being done to natural populations of native plants by senseless field collecting either by individuals or by commercial sellers of wildflowers. This is in addition to the destructive activities brought on by development. Field collected plants usually exhibit greater "transplant shock" and require more effort to establish as garden plants than do propagated plants of the same species which have been grown from seed or cuttings and are essentially "cultivated" from the beginning of their existence.

Another manifestation of our concern to develop an ethical way of securing native plant material is our NCBG Volunteer Plant Rescue Team. It operates state-wide in cooperation with the highway department, Corps of Engineers, and private developers to remove plant material that is scheduled to be destroyed. These plants are shared with other gardens and are planted in our habitat collections or nursery areas.

One of the outstanding features of the Garden is its Carnivorous Plant collection. It is perhaps the finest collection of native CP on public display in the eastern United States. In addition to the naturally arranged habitat plantings displaying CP from N.C., it contains many other types from the Southeastern U.S. and other parts of the world. The heart of our CP collection are the *Sarracenia*, which are maintained in plastic pots. Some of the rarer plants in the collection include *S. alabamensis*, *S. oreophila*, *S. jonesii*, and *S. purpurea* forma *heterophylla* (all grown from seed provided by Fred Case) and the beautiful pink-petaled form of *S. purpurea venosa*. We also have an interesting group of *Sarracenia* hybrids, both natural and artificially produced here at the Garden. We now grow from seed all our CP's, both for the collection and for the habitat plantings. The body of our collection is housed in several sub-irrigation nursery beds under slightly shaded conditions. Plants are drawn from this area or returned to it depending on their seasonal presentability. For example, during the fall, *S. flava* is beginning to show wear and tear so most of them from the display area are returned to the nursery and replaced by pots of *S. leucophylla* which are putting on a flush of vigorous growth at this time.

All hardy plants are kept outside for winter dormancy (minimum winter temperatures in Chapel Hill are usually about −12°C (10°F) ). The pots are usually sunk to the rim in sawdust beds in the nursery. This dormancy requirement can be over-ridden if plants are grown in a greenhouse under lights, but in the long run, healthier and much longer-lived specimens result from observing their natural rest period.

Fresh seeds of all *Sarracenia* species are sown in the fall on whole-fiber sphagnum moss and placed outside in the nursery area for the winter. Stratification (cold and moist) of *Sarracenia* seeds is an absolute necessity to realize a high percentage of germination. Seeds begin to germinate in late April of the following spring. These seedlings are kept in their flats the entire first summer and through the next winter. Transplanting is usually done the spring of the second growing season. All CP's are germinated and grown in whole-fiber sphagnum moss. Several other growing media have been tried with satisfactory results, but sphagnum seems to be best. Pots of mature *Sarracenia* are top-dressed with living sphagnum. Similar propagation programs are conducted for a variety of *Drosera*, *Pinguicula*, *Dionaea*, and *Utricularia*. NCBG is a contributor to the CPN seed bank under the able direction of Patrick Dwyer. In the past we have been

(Continued on page 114)

The fate of all too many stands of CP.

Photo by Rob Gardner

CP rescue team. We need more of them.

Photo by Rob Gardner

*Sarracenia psittacina*
Photo by Larry Mellichamp

CP Collection at North Carolina Botanical Garden.
Photo by Rob Gardner

able to donate quantities of *S. minor, S. jonesii, S. flava, Dionaea,* and other native CP. Please direct your seed requests to the CPN Seed Bank, NOT to NCBG.

The Garden offers a native plant seed exchange service for its members. Much of the cleaning, processing, recording and correspondence for this service is done by volunteers.

Although the great majority of our CP remain outside in the nursery for the colder months, we keep a small but representative collection of them to display in an unheated greenhouse. This helps meet their dormancy requirements while preventing the hard freezes from killing back the foliage and allows them still to be of interest. We begin to bring selections of our nursery collection into a heated greenhouse in January to initiate active growth. This, along with the early activity in the unheated greenhouse specimens, allows us to have some plants growing and flowering at different stages long before outside temperatures are suitable. (The average high temperature in our area in January is 42-44°F, but it quite often is below freezing for several days at a time.) This way we can have *Sarracenia* blooming from late February through the natural season to late May.

If you are planning to be in our area, you should definitely plan to include a visit to the NCBG. The best time to visit our unique habitat-concept collections, as well as the CP display collection, is April-May. However, there is always something to see or do: maybe attend a spring or fall wildflower workshop, a winter botany hike, or venture on an NCBG-sponsored field trip. Such field trips even include tours of the world-famous Green Swamp where we jump over (or wade through) roadside ditches choked with water-lilies and pick our way through sphagnum mats trying to avoid treading on a literal carpet of sundews, pitcher plants and flytraps!

The staff and volunteers of the NCBG are proud to have for the education, convenience, and interest of the general public and its members these activities and collections; and to be fully committed to a progressive native plant conservation ethic. We invite you to join us!

For more information on the North Carolina Botanical Garden write:

N. C. Botanical Garden
UNC — Chapel Hill
Totten Center 457-A
Chapel Hill, N.C. 27514
phone (919) 967-2246

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(Continued from page 108)

be avoided by using darker parents, though I have noticed a tendency for later hybrid generations to become pale. Both of these crosses were made by Adrian Slack who kindly sent me the seed.

Some back crosses and close to back crosses are interesting. I crossed *alata* x *leucophylla* with *leucophylla* in the hope of getting the vigour of one and beauty of the other. I did, but the wrong way round — dirty white *leucophylla*-like plants which did not increase quickly (fortunately!)

On the other hand *S.* (*flava* x *purpurea*) x *alata* has produced attractive and quite varied offspring.

I feel in hybrids one needs to work on or around a given species, e.g., as Adrian Slack did with *S.* x *excellens* x *S.* x *wrigleyana* where *leucophylla* is a parent of both.

*S.* (*flava* x *purpurea*) x *alata* has emphasised the closely related *flava* and *alata.*

For colour, one only has *purpurea, minor, psittacina* and *leucophylla* — only one tall species. In my experience the others give pale progeny, but using selected dark varieties and with rigid culling, results should improve.

## Question and Answer

In Graff's TROPICA (Roehrs Co. Publishers, East Rutherford, NJ 07073, 1978, p. 292), he refers to two forms of *Dionaea muscipula*: one simply as *D. muscipula,* the other as *D. muscipula* 'coccinea'. Is this nomenclature officially accepted? (Robert Syrlik, 217 Drake Ave., Apt. 3J, New Rochelle, NY 10805).

Your question brings up a very good point. It is well knows that botanists are goverened by a very exact — and oftimes confusing — set of nomenclature rules known as the ICBN. There is a similar set of rules for horticulturists, but all too often they are ignored and unregistered names crop up in the literature. Since the term coccinea is in single quotes, it implies a horticultural term rather than a botanical ssp., form or variety. The term is derived from Latin and means "scarlet", and seems to refer to the intensely red color that some plants of the species develop on the inner surfaces of their traps. The intensity of red coloration is certainly related to light intensity, but there is also a genetic factor in that plants side by side in the same habitat, or transplant situation, may have consistantly yellow-green or deep red traps interior surfaces, and there are intermediates as well indicating hybridization. This is somewhat similar to the situation wherein grades of petiole variation also *seem* genetically determined (but individual plants may go thru the entire cycle as the season goes on, often at different times) with variation from prostrate wide petioles, to erect, very narrow to triangular petioles, four degrees of this being recognized by some horticulturists. However, as far as we are able to determine, there has been no officially acceptable description of these variants in an acceptable journal format. This is not to criticize the validity of such differentiations which may ultimately serve useful botanical or horticultural purposes. But those who initiate such nomenclature are bound to publish it according to rules, and give their arguments for the names. (DES)

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SPECIAL NOTICE

Don Schnell reports that the special *Pinguicula* photo-slide project (See CPN 8:52-53, 1979, June) has gone well. He estimated the initial stock of slide sets well since as of now there are only two left. No additional copying was required. As mentioned, there are two sets left and those readers who are interested but delayed beyond the 15 Sept. 1979 deadline, or those new subscribers just learning of the set, can still order while the supply lasts. The first two orders received will be processed, orders and checks received after the two sets are sold will be returned promptly to the sender. See p. 52-53 of the June, 1979 CPN for details of what the set consists of, cost, and ordering procedure.

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(Seed Bank, cont. from page 99)

*oreo.* (14), *S. leuco.* x *flava* mixed with *S. leuco.*, *S. leuco.* x *minor*, *S. leuco.* x *rubra*, *S. leuco.* x *wrigleyana* (1), *S.* x *mitchelliana*, *S. mitchell.* x *flava*, *S. purp.* x *flava*, *S. purp.* x *leuco.* $F_2$, *Sarr.* mix; *Utricularia inflexa, U. montana.*

For information on sending or ordering seed, see CPN 8:4.

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SPECIAL NOTICE

In view of serious cultivar and "pseudo-cultivar" nomenclatural problems as outlined by Robinson in the June CPN, and Mellichamp in the September issue, we are seriously considering establishing a department within CPN for the proper naming, description, publication and registration of CP cultivars. We already have an individual seriously interested in running the department for us in a capable manner. CPN would thus become an acceptable organ for publication and registration of such cultivars. Watch future issues for more information on this matter as we develop the project.

*Sarracenia flava* dark throat
Photo by Larry Mellichamp

*Sarracenia minor*
Photo by Larry Mellichamp

Pink-flowered *S. purpura venosa*
'Louis Burk' in West Florida
Photo by Larry Mellichamp

*S. flava* — green type
Photo by Bob Hanrahan

# EXPLORING FOR PLANTS IN THE SOUTHEASTERN STATES

By Dr. Edgar T. Wherry[1]

Reprinted from Scientific Monthly, Vol. 38, 1934

One of the most pressing tasks of the plant geographer is to ascertain as fully as practicable the present distribution of the various kinds of plants over the surface of the earth, before civilized man succeeds in destroying all natural habitats and exterminating their occupants. While many manuals and floras give in a general way the ranges of such species as occur within the areas covered, accurate distributional data are at hand for very few. The lack of such information is especially serious in the case of plants endemic to the southeastern United States, where there has been so little collecting that the range of even conspicuous objects like the pitcher-plants is but imperfectly reflected by specimens in herbaria. I was accordingly especially glad to be invited by Mr. Louis Burk, the well-known Philadelphia horticulturist, to obtain for him a complete collection of the species and varieties of *Sarracenia*, in the summer of 1932. Not only would such a trip make it possible to fill in many gaps in the recorded ranges of these plants, but also there would be a chance to study in the field undescribed ones as to which more or less unsatisfactory data were at hand.

Late in June I drove to Washington, D.C. and was fortunate in having Mr. James E. Benedict, Jr., join me for the trip. Continuing southward on U.S. Route 1, our first stopping point was Raleigh, North Carolina, where we called on Professor Bertram W. Wells (who just recently died in 1979). He not only furnished us information as to pitcher-plant localities in the southern part of the state, but also showed us a tiny meadow not far from the city where by good fortune a few pitcher-plants still survived the encroachments of agriculture. Two species were represented, the widespread yellow pitcher-plant (*S. flava*) and a relative of the side-saddle pitcher-plant (*S. purpurea*), which we especially wished to study. In his "Autikon Botanikon," published in 1840, Rafinesque had pointed out what he considered specific differences between the northern and southern representatives of this species, and had named the southern one *S. venosa;* but his work has been ignored by all subsequent students of these plants. At this locality its aspect was certainly quite unlike that of the familiar pitcher-plant of New England and the Great Lakes region, and we felt disposed to accept Rafinesque's interpretation of it; but other occurrences seen in the course of the trip indicated the two to intergrade too much to be maintained as independent species. Additional data as to pitcher-plant localities were obtained from Professor William C. Coker at Chapel Hill, and we set out for central Georgia. At Macon we were joined by Dr. Charles C. Harrold for a two-day trip on the coastal plain of the state.

As we traveled southeast, pitcher-plants began to appear in the swamps in the vicinity of Swainsboro; these comprised not only the tall and conspicuous *Sarracenia flava*, but also the diminutive hooded (*S. minor*) and parrot pitcher-plant (*S. psittacina*). Michaux had reported the latter from "Augusta, Georgia, to Florida," and, desiring to obtain roots from as far north as possible, we kept searching for it in one county after another, but the most northern colony to be found lay 10 miles south of Millen and thus fully 50 miles south of Augusta. Several rooted clumps were collected, packed in wet moss, carried with us until we could find a state inspector and get them certified as pest-free, and then shipped home. Some of these were planted outdoors in a wild-life preserve controlled by Mr. Burk in southern New Jersey, where they have survived the first winter, at least. The remainder were held in a cool greenhouse, and bloomed freely during early spring.

Pitcher-plants were, however, not the only thing to claim our attention in this part of the country. We planned to make an effort to rescue a native tree which is on the verge of extinction. This plant, discovered by Stephen Elliott in the early 1800's and named in his honor *Elliottia* by Muhlenberg, is a primitive member of the heath family. The genus is monotypic, being represented by the single species *E. racemosa*, and its nearest relative is the genus *Tripetaleia* of Japan. These are evidently relics of the late Cretaceous and early Tertiary floras which spread widely over northern lands, but have been restricted by subsequent geological events, especially the Pleistocene glaciation, to remote isolated areas.

Showiest of all the species of *Sarracenia* is the white-top pitcher-plant, usually known technically as *S. drummondii*, although Rafinesque's name *S. leucophylla* has many years' priority. (It is now officially known as *S. leucophylla*). Amateur botanists have reported it

[1]Edited by T. L. Mellichamp for publication in CPN.

to grow as far up as North Carolina, but the northernmost locality represented by specimens in herbaria is Americus, Georgia. After an hour's search in that vicinity we found in a swamp a small colony which, by a fortunate chance, had not been destroyed by cultivation. Here the stock of the species for Mr. Burk's collection was obtained, and although it is still too early to tell whether the clump planted outdoors in southern New Jersey will survive, those wintered over in the cool greenhouse have grown and bloomed well.

Another member of the genus does not grow east of Mobile, Alabama, so we traveled slowly toward that place, collecting various plants of interest along the way. The technical name of the species in question is *S. sledgei* (now known as *S. alata*) Macfarlane, and, as its flowers are lighter in color than those of any other species, it seems most aptly termed the pale pitcher-plant. This proved to occur in a number of swamps, and we soon had some plants ready to send off. Here we were so fortunate as to meet Mr. T. S. Van Aller, who not only inspected our plants and certified them as safe for shipment, but also guided us to several pitcher-plant meadows which we would not have found otherwise. In most of the localities draining, burning and other destructive activities of civilized man have greatly reduced the numbers of these plants, but one locality near Theodore proved to be still undisturbed. Here countless thousands of *S. sledgei* and *S. drummondii* grew together, along with a host of hybrids showing every conceivable gradation between and combination of the characters of the two parents. It seems a pity that there is no one in the region sufficiently interested in conservation to buy up this brief meadow and save it for investigation by geneticists and enjoyment by nature lovers of the future.

In April, 1910, while carrying on his fascinating studies of the relations between insects and pitcher-plants, Dr. Frank Morton Jones had spent some time at Theodore, and had observed in one nearby meadow a pink-flowered form of *S. venosa*. He had furnished us approximate directions as to its location, and we soon found what appeared to be the right spot. In July, of course, pitcher-plant petals are withered, but we dug a few plants and shipped them to Philadelphia in the hope that they might bloom in the greenhouse the following spring. This hope has now been realized; and it turned out that we had struck the right spot. The parts of the flower which in most pitcher-plants are green or bronzy — the bracts, sepals and style-umbrella — are in this one nearly white, while the petals have a lovely rose color, unlike that of any other *Sarracenia*.

In Chilton County we located a colony of a red-flowered pitcher-plant, but it was not in good enough condition to establish its identity, (now known as the newest species of *Sarracenia, S. alabamense* Case.) We then set out for the valley of the Little River east of Fort Payne, where a yellow-flowered one was reported. In spite of many hours' search in every conceivable type of habitat, we were unsuccessful in finding it there, but Dr. Harper had fortunately observed it, also, near Center. On reaching that place we found that, although recent clearing of the land for agriculture and burning over of the swamps, even where no such use was practicable, had nearly exterminated it, a few small clumps had somehow managed to escape destruction. Both in the field and in the greenhouse, where it bloomed the following spring, this plant showed a number of differences from its nearest relative, *S. flava,* and is to be classed as an independent species, (now known as *S. oreophila.*)

The mountains of North Carolina were our next objective, for there grows the red-flowered pitcher-plant known as *Sarracenia jonesii,* the distinctness of which had only been recognized in 1929. Its colonies proved to have been nearly destroyed by drainage of the swamps and by the raids of vandals from the towns, but enough remained to enable this species to be added to the collection. With it grew some beautifully veined *Sarracenia venosa.* Ordinarily, when two closely related species or varieties exist the more southern one tends to grow in the coastal plain, the more northern in the mountains; in this case, however, the southern representative grows both at low and high elevations. We also found hybrids between *S. venosa* and *S. jonesii.*

Leaving the mountains, we next drove to Charleston, South Carolina, where some of the specimens in the Elliott Herbarium, preserved at the Charleston Museum, were studied, and then made for Summerville. How abundant pitcher-plants formerly were here is well shown by the splendid photograph in Macfarlane's Monograph on the family in Engler's "Pflanzenreich"; but when we reached the spot where this had been taken, a very different sight met our eyes. Drainage of the swamps and burning of the woods had destroyed practically everything, and it was only after considerable search that we found even a single pitcher-plant in the midst of the rank, weedy grass and brush that had come in.

Three species of pitcher-plants remained to be collected at the northern-most margin of their range, so that they would be as hardy as possible. Eastern South Carolina proved, however, to be poor collecting ground, for droughts extending over a period of years had so lowered the water-table that many former

swamps were now dry land. Moreover, the local farmers had taken to planting crops in the lower areas, and many a time when we pushed through pine woods toward what should have been a *Sarracenia* bog we found only a *Zea Mays* (corn) or Gossypium (cotton) bog instead. *Sarracenia minor* was finally obtained in the neighborhood of Florence, South Carolina, and we then made for Lake Waccamaw, North Carolina. A few months before, Mr. Benedict had discovered here a northern outpost of the Florida swamp-fern, *Dryopteris floridana,* and of this we were able to obtain a good series of pressed specimens.

The sweet pitcher-plant, *S. rubra* eluded us for some time, but we finally located it in wet woods on the outskirts of Fayetteville, and roots were duly collected. Before leaving this part of the country, an attempt was made to obtain some of the remarkable little insectivorous plant, *Dionaea muscipula,* from a northern marginal occurrence, but the drought proved to have destroyed practically all of it, and only a very small clump could be obtained for planting out in the New Jersey preserve. Here it has survived the first winter, however, so there is some hope that it may become established there. The last pitcher-plant, *S. flava,* was obtained near New Bohemia, Prince Charles County, Virginia, and the series was complete.

## News and Views

(Continued from page 105)

In another normally drier field, *Dionaea* were smaller than usual and I also noticed *Pinguicula lutea* development was poor with several that had shriveled and died due to lack of water. Fortunately, it started raining later in the afternoon and would continue to do so for several days according to the forecast. The best surprise of the trip was locating my first natural hybrid *Sarracenia.* It was probably one that had *S. purpurea* as one parent and I'm not sure of the other parent. The plant is now doing fine in my greenhouse and in the two weeks since my return, it has already grown a new pitcher.

ROBERT SYRLIK (217 Drake Ave., Apt. 3J, New Rochelle, NY 10805) is trying to start a CP club in the greater New York City area. Subscribers who are interested are asked to write him at the above address or phone (914) 576-2423.

DAVID TAYLOR (The Everglades, 76, Crosslands Ave., Norwood Green, Southall, Middlesex UB2 5RA, GB) sent the following news about the 1979 Chelsea Flower Show and CP: "Well the fabulous Chelsea Flower Show is over for another year, and what a great success it was for CP. I have never quite experienced anything like the sheer spectacle that took place in that particular week. The CP society exhibit was so good, that I was personally told by members of the general public, that it was the talk of the show. This would account for the enormous numbers of people that surrounded the exhibit all that week. Members of the society were interviewed by the press and television media, and many of the fine plants on the stand were shown on British television. The whole subject of CP really took off, and the public interest brought a flood of new members to the society. I have never seen so many people scrambling to see our exhibit, and also trying to photograph the plants.

"One of the results of the show was the award of a RHS silver gilt medal to the CP society. This was indeed a very high honour and was certainly unexpected."

STEPHEN E. WILLIAMS recently attended the Tenth International Conference on Plant Growth Substances in Madison, Wisconsin on 22-26 July 1979, which had a section on plant movements. The following abstracts were forwarded to us by him as items of CP interest.

ACTION POTENTIALS AND RAPID PLANT MOVEMENTS. *Takao Sibaoka,* Biological Institute, Faculty of Science, Tohoku University, Sendai, 980 Japan.

When a transmitted (petiolar) action potential (AP) arrives at apical end of main pulvinus of *Mimosa* another type of AP is elicited here and spreads throughout the pulvinus within 0.1 sec. Rapid fall of leaf be-

gins 0.01-0.02 sec after peak of pulvinar AP. If a sensory hair is stimulated an AP spreads over whole area of *Dionaea* trap within 0.25 sec. Closure of trap occurs about 0.5 sec after spread of the second AP which is elicited by 2nd stimulus less than 20 sec after 1st one and has 2-4 time faster velocity than the first AP. Both lobes bend almost instantaneously (at 0.01-0.02 sec interval). In *Aldrovanda vesiculosa* transmission time of AP in whole area of trap is very short (0.05 sec) due to its small size. Trap closure begins 0.05 sec after generation of AP in cells of motor zone. Time difference between mechanical responses of both lobes is about 0.004 sec. Thus, rapid plant movement can be explained as mechanical response triggered by AP in motor cells, in which excitation-turgor-loss coupling may exist.

THE ROLE OF ACTION POTENTIALS IN THE CONTROL OF CAPTURE MOVEMENTS OF *DROSERA* AND *DIONAEA*. *S. E. Williams* and *B. G. Pickard*, Lebanon Valley College, Annville, PA 17003 and Washington University, St. Louis, MO 63130.

The first action potentials discovered in plants were found in *Dionaea* in 1873 by Burdon-Sanderson as the result of an experiment suggested by Darwin. Similar signals have been found in *Drosera*. Comparison of the control mechanism of the two plants indicate that the trapping mechanism of *Dionaea* is likely to be a modified version of that in *Drosera*. Both have rapid, nastic action-potential mediated movements and slower tropistic movements which are not mediated by action potentials and are presumably controlled by hormones. A single action potential in either plant will not induce much movement but a second following soon after will. The two plants differ most notably in the region through which the action potentials propagate. In *Dionaea*, action potentials initiated in a sensory hair pass through a large portion of the leaf blade but in *Drosera* an action potential does not pass beyond the base of the sensitive hair and the rapid movements are restricted to that hair. Repetitive action potentials induce secretion by the digestive glands of *Dionaea* but it has not been established whether secretion is similarly controlled in *Drosera*.

Burdon-Sanderson began studies of *Dionaea* in 1873 which indicated that the degree of responsiveness of a trap increases when it has been previously stimulated and that the degree of increased responsiveness decays as time between stimuli increases. Brown (1916) Amer. J. Bot. 3,68, obtained more precise data on the traps' responsiveness to stimuli delivered at even intervals between 20 s and 20 min. Ashida (1934) Mem. Coll. Sci., Kyoto Imp. Univ., B,9,141, proposed a mechanism of trap movement which was made into a quantitative model by Cooper, Fleischman and Williams and fit to the data of Brown. This model predicts that at intervals of stimulation greater than 3 min the reopening mechanism of the trap must be considered and that at intervals greater than 7 min competition of the active cells of the trap with neighboring cells for solute lost during closure is important. The competition of cells which are not active in trap closure with active cells should result in a delayed reopening of these traps. This result has been experimentally confirmed. When fitted to Brown's data the model predicts traps stimulated at intervals greater than 170 min will never close. When Brown's experiment was repeated, the data obtained could also be fitted with the mathematical model using different constants.

## Question and Answer

I noticed that plants potted from dried sphagnum moss acquired from mail sources do not do well and in fact die until it is at least 6 months or older. Why does this happen and is there anything I can do to counteract this happening? T. S., Antioch, CA.

Dried sphagnum moss has been injured in such a way that many of the cells are broken open and various nutrients, namely, starches and sugars, are released. These nutrients are food for whatever bacteria and fungus organisms are around when the moss is kept moist for a long time. Some of these organisms may be harmful to your CP plants. When the food supply runs out and the moss begins growing into green tufts, then the moss is ready to be used for growing CP. I suggest that you keep a moist bundle of this moss on hand and use it only when you see it starting to grow green tufts. J. A. M.

# BOTANIST'S CORNER

by Larry Mellichamp

## Botanical History of CP V: John M. Macfarlane

Over the years, much information is accumulated about plants which have become popular or conspicuous for one reason or another. This information may be botanical or horticultural, as both are equally valid avenues of interest to pursue (or even to combine) as one grows attached to the plants he/she works with. Periodically, it becomes necessary to draw all the known data together into a grand synthesis so that a clear picture of the group in question emerges and the information is made readily available to those who need and desire it. One of the greatest syntheses of all times was Darwin's "Origin of Species" wherein he amassed much data and observations to support his theories of evolution and to show others the evidence. On a lesser scale, but of no less important efforts, has been an example closer to home, namely the magnificent volume on Carnivorous Plants published by Francis E. Lloyd (a Canadian) in 1942. In this interesting and innovative compendium, all of the botanical data from many scattered sources was consistently presented in one book. CP had been intensely studied for over half a century and this was the first real synthesis for the group. It also led the way for more efficient future research in the field.

In getting to the main subject of this article, I would like to call your attention to one of the truly great botanists and proponents of CP of the past hundred years. I am referring to John Muirhead Macfarlane, for his 60 and 70 year old compilations on the botanical and horticultural aspects of CP are well-known and often consulted even today. His two best known horticultural works are the treatments of *Nepenthes* and *Sarracenia* in L. H. Bailey's Standard Cyclopedia of Horticulture in 1917. They are still very useful, although more species and hybrids are known and some names have changed, and serve as models for modern revisions which are sorely needed after so many years of progress in these two most important groups of CP. He is also to be remembered for his definitive botanical monographs on the Nepenthaceae and Sarranceniaceae. These lengthy articles crystalized our knowledge of these difficult families in the world renowned taxonomic series *Das Pflanzenreich* ("the plant world") of the German botanist Adolf Engler, whose goal it was to systematically treat all species of plants known in the world at that time.

It is reassuring to believe that the job of compiling and synthesizing all of the necessary information into usable reference works on these plants was successfully acomplished by such a capable man. It would be hard to follow in his footsteps today when so much more knowledge is available in even more widely scattered sources about such complex groups of plants. Nevertheless, we are making an attempt at synthesis and education through CPN by providing a forum for presenting information and sharing experiences. Perhaps someday a unified work will result from the data gathered here.

John M. Macfarlane (1855-1943) was born in Kircaldy, Scotland and received a Bachelor of Sciences degree (1880) and a Doctor of Science degree (1883) from the University of Edinburgh where he specialized in Botany. He spent the next ten years teaching and doing research

on living and fossil plants at the University of Edinburgh, where in 1887, the Committee of the Association for the University Education of Women appointed him lecturer for the year and his class was attended by 62 students. In 1891 he made some remarkable discoveries regarding the sensitive movements of the Venus Flytrap. Later that year, after delivering a speech on his insectivorous plants studies to the American Association for the Advancement of Science in Washington, DC, he was offered a professorship in biology at the University of Pennsylvania. He accepted and became a Professor of Botany in 1893, remaining until his retirement in 1920.

At the University of Pennsylvania he immediately put his untiring energies to work on improving the Botany Department. He became director of the botanic garden for 27 years where great advances and improvements were made; he greatly enlarged the botanical library from 17 volumes in 1893 to over 5,000 volumes; greenhouses were erected and large collections of plants were amassed; laboratories were equipped with apparatus; and he attracted many students to the botany courses there. Not only was he concerned about the well-being of his students and colleagues, but he also felt that the general public should become involved in the University and botanical activity; so he founded the Botanical Society of Pennsylvania in 1897. He was a prolific writer and researcher, not only dealing specifically with CP, but other aspects of Botany, Zoology, and Evolution as well. The accuracy and usefulness of his work is reflected in its timeless recognition. He is commemorated by the name *Nepenthes macfarlanei*.

Macfarlane's writings can be followed by the references listed in Lloyd, F. E., Carnivorous Plants, 1942.

1. *Sarracenia lucophylla*
2. *S. alata*
3. *S. psittacina*
4. *S. flava*
5. *S. rubra*
6. *S. alata x S. psittacina*

Drawing by R. S. Bennett

# Review of Recent Literature

Adams II, RM and SS Koenigsberg, RW Langhans. 1979. In vitro propagation of *Cephalotus follicularis* (Australian pitcher plant). Hort Sci 14:512-513.

Rapid clonal multiplication of shoot tip material of the species was achieved with a 5-10 fold increase of plant material. The method offers a relatively inexpensive and rapid method of producing clonal offspring commercially. Details of media used, modifications and references are in the paper.

Barron, GL. 1979. Nematophagous fungi: a new *Arthrobotrys* with nonseptate conidia. Can. J. Bot. 57:1371-1372.

A new species of carnivorous fungus with loop traps, *Arthrobotrys botryospora*, is formally described and illustrated.

Beckner, J. 1979. A method of growing the impossible bog orchids. American Orchid Society Bulletin 48:556-560.

The author, who lives in St. Petersburg, FL, concentrates mainly on outdoor culture of terrestrial orchids, but also grows various CP as companion plants with his orchids. The article should be read for details, but briefly is as follows: All plants are grown outdoors in full sun in plastic tubs or wading pools raised off the ground. The growth medium is 5 parts perlite, 3 parts vermiculite, 2 parts of Canadian peat. A few drainage slits are placed in tubs with a knife just a few cm. below the soil surface, so there is always deep moisture in the medium. Plants are placed shallowly in this medium since the whole is finally top dressed with live sphagnum an inch or so deep. The author claims all plants flourish by this method in his area.

Harms, V. L. The native carnivorous plants of Saskatchewan. Blue Jay 36 (2): 71-81 (1978).

Mr. Dale Speirs sent in this article from the journal published by the Natural History Society. The author describes and indicates the distribution on the province map the following species : *Sarracenia purpurea, Drosera rotundifolia, anglica* and *linearis, Utricularia intermedia, vulgaris, minor* and *cornuta* and finally *Pinguicula vulgaris* and *villosa*.

Kondo, K. and RM Adams II (Illustrations by R. Scott Bennett). 1979. Forbidding Beauty: Orchid - flowered butterworts. American Horticulturist 58:29-33.

A generally good introductory article on the Mexican Pinguiculas with heavy emphasis on cultivation. The sumptuous frosting on the whole thing is contributed by the superb artwork of R. Scott Bennett who has provided three full color plates (one is also reproduced on the covers) that are works of art and meticulously produced. The publisher has used an excellent color separation process, but alas one wishes that the flower color of *P. gypsicola* had been printed more accurately (It is actually an 82AB purple-violet group rather than the 96AB violet-blue group shown — RHS Colour Chart, 1968). There are three points in the text that bear discussion, one of accuracy and two of point of view. The anther is described as being located beneath the ovary in *Pinguicula* flowers; in fact, the stamen filament is inserted just below the ovary whereas the actual pollen-bearing anther is immediately beneath the apron-like, flattened extension of the stigma. Also, this reviewer believes that in the case of Mexican Pinguiculas, the grower should also refer to the "soil" medium recommended by Mazrimas (CPN 8:46-7) which is better drained than sphag-

num and where hydration is actually easier to control in a situation where one wishes to prevent a soggy medium. I have been growing my plants in a rapidly draining perlite medium for some time and like it much better than sphagnum, the latter still being useful for some temperate species. Finally, Casper (Brittonia 18:19-28, 1966) is used as the sole taxonomic reference. The serious *Pinguicula* enthusiast will wish to know that there are other points of view. Indeed, the Casper paper is a rebuttal attempt, and one may wish to know what he is trying to rebut. The culprits are Rogers McVaugh and and John T. Mickel (Brittonia 15:134-140, 1963), and you will want to read this paper which provides different taxonomic insights. McVaugh is a highly experienced and widely recognized expert in Mexican botany who was recently singularly honored by having an issue of the prestigious journal TAXON dedicated to him (Taxon 28(1,2), 1979). It is a question of the lumpers (McVaugh and Mickel) vs. the splitters (Casper), each with chosen references lined up behind him. Casper's argument that McVaugh and Mickel did not recognize seasonal heterophylly is untrue since the factor is mentioned often in their paper. Finally, Casper simply declares that everyone else has completely misunderstood Mexican Pinguiculas. McVaugh and Mickel bring out an excellent point of the severe limitations of classical dried herbarium specimens of Lentibulariaceae. Countless photos of such ciphers mar the otherwise excellent monograph on Pinguiculas by Casper (Bibliotheca Botanica, Heft 127/128, Stuttgart, 1966) where field and culture photos would have been far more useful. One cannot appreciate the color art in this article in a Xerox copy, so readers are encouraged to purchase individual copies of the magazine which are available (Send $2.50, specify August/September, 1979 issue of American Horticulturist, and mail to American Horticultural Society, 7931 East Boulevard Dr., Alexandria, VA 22308).

Kondo, Masahiro. Carnivorous Plants. Nagoya Insectivorous Plant Society, 1979.

This 32 page booklet was printed in Japanese as a special issue on carnivorous plants by Katsu Kondo's father and published by the Chunichi Horticultural Society at Nagoya, Japan. Although it deals with all genera of CP, there is an interesting table of *Nepenthes* hybrids which we have permission to reprint in CPN. The booklet has some B&W photos of hybrid *Nepenthes* not seen before in other Japanese publications.

Meyers, DG and JR Strickler. 1979. Capture enhancement in a carnivorous aquatic plant: Function of antennae and bristles in *Utricularia vulgaris*. Science 203:1022-1025.

The authors present good documentation as a result of observations on *U. vulgaris* traps after progressive excission of trap appendages that tend to confirm Darwin's hypothesis that the antennae and bristles surrounding the trap door act as a funneling mechanism for directing small aquatic prey towards the door and its trigger hairs.

ONTARIO NATURALIST, Vol. 19, No. 2, Summer, 1979.

It is not often that we review an entire issue of a journal or magazine, but this particular issue warrants such consideration. ONTARIO NATURALIST is the publication of The Federation of Ontario Naturalists, an organization to which all Canadian CP enthusiasts should belong, and those Americans in the Northeast or who otherwise frequently botanize in Ontario. The Summer, 1979 issue is devoted to the subject of inland wetlands. The article by Dr. John H. Sparling (pp. 10-17) is alone worth the entire issue. This article is complemented by "Wetland

Primer" (pp. 29-34), a "centerfold" treatment of excellent photo illustrations of the wetland types described by Sparling. The importance of the two articles lies in the general confusion of when to use such various terms as swamp, marsh, bog and fen, and various subclassifications of these entities. British and Canadian naturalists use the term "fen" more often than Americans. Thus, what we often call a "marl bog" (perhaps colloquially?) is in actuality a kind of fen. Bogs are herein described as originating at pond, lake or stream margins, or upon old fens, and of course contain masses of sphagnum mosses in which certain ericaceous shrubs grow. The whole business of how to clasify wetlands is in some disarray. Elsewhere in the issue, Dr. Sparling is described as one of only a half dozen wetlands specialists in Ontario, and even they disagree in some aspects of classifying these vital areas — what to call any one. This difficulty is partially due, of course, to the nature of wetlands which well may be composites or spectra of several types intermingled. I would have preferred more than casual mention of the kettle or pond bog, and raised bogs founded on old fens may very often have underlying or adjacent diffuse springs as a water source rather than almost always being restricted to rain. Other than these two minor criticisms, the issue is strongly recommended as "must" reading for those interested in northern wetlands. The discussion, by the way, holds equal usefulness for Americans as well. The issue can be obtained for $2.00 from the Federation of Ontario Naturalists, 355 Lesmill Rd., Don Mills, Ontario M3B 2W7, Canada.

DES

Soepadmo, E. Pitcher Plants. Nature Malaysiana Vol. 2, pp. 38-43 (1977)

This magazine article describes the ecology and pitcher plant community in Malaysian lowlands and highlands. Nine species are pictured in beautiful color including *N. alba, macfarlanei, gracillima* and *sanguinea*. We would like to thank Geoffrey Wong for alerting us to this article and the list of four below which describe the ecology of *Nepenthes.*

C. G. G. J. van Steenis, *The Mountain Flora of Java,* E. J. Brill, Leiden, Netherlands, 1972, 90 pp.

C. G. G. J. van Steenis, "The Age of the Kinabalu Flora," *Mal. Nature J.* 20, 39-43 (1967).

C. G. G. J. van Steenis, "The Mountain Flora of the Malaysian Tropics," *Endeavour,* 21, 183-193 (1962).

*Proc. Royal Soc.* (London) B, Vol. 161; several articles on the national history of Mt. Kinabalu.

Tronchet, A. 1977, La sensibilité des plantes. Paris: Masson, 158 pp. P. 61-97. IN FRENCH.

Bentrup, FW. 1979. Reception and transduction of electrical and mechanical stimuli. In Physiology of movements, Encyclopedia of plant physiology, Vol. 7 (W. Haupt and ME Feinleib, ed.) New York: Springer-Verlag, p. 42-70.

Both of the above book chapters contain excellent, detailed summations of movement and electrophysiology of Droseras, *Dionaea* and Utricularias. References are current, including several papers by Stephen Williams whose work has been mentioned in this column several times and who has contributed to CPN.

Tzean, SS and RH Estey. 1979. Transmission of electron microscopy of fungal nematode-trapping devices. Can J. Plant Sci. 59:785-795.

The nematode-trapping devices of carnivorous fungi *Arthrobotrys dactyloides* constricting rings), *Monacrosporium cionopagum* (adhesive columnar processes and scalariform loops) and *Dactyella* sp. (sticky knobs) were studied to determine organelle changes coincident

# WANT ADS

When submitting Want Ads, please be sure to print clearly for best results and to eliminate mistakes. Please indicate the correct letter before each item (Want, Trade, Sell or Buy). Want ads are limited to carnivorous plants, terrariums, greenhouses and moss. There is a charge of ten cents per item, with no limit to the number of items you may submit per issue.

Send coin or check to:
Arboretum, Want Ads
California State University
Fullerton, CA 92634

Richard Chinnock, 3316 Old Kirkwood, Virginia Beach, VA 23452. (WB) Indoor Greenhouse, D. schizandra, D. prolifera, Heliamphora Plant (any species). (TS) Aldrovanda vesiculosa.

William Clemens, 3147 Steele Manor #3, Memphis, TN 38127. (WTB) Byblis gigantea seed, Drosera regia seed or plants, Drosera villosa plants or seeds, Heliamphora (any species, plant, seed, cutting). (TS) Cephalotus follicularis, Drosera burkeana, Sarracenia purpurea pur. seedlings, Drosera brevifolia, D. rotundifolia, D. hamiltonii, Sarracenia psittacina, Darlingtonia californica.

Anthony Ford, 320 E. O'Keefe, #4, Palo Alto, CA 94303. (WB) Drosera schizandra, D. macrophylla, D. erythrorhiza, D. zonaria, D. arcturi, D. prolifera, D. pulchella, D. hamiltonii, D. bulbosa, Nepenthes rafflesiana (plants or cuttings of all of the above).

Jeffrey Gold, 13126 Anza Drive, Saratoga, CA 95070. (WB) seeds, plants, cuttings, or divisions or epiphytic, orchid-flowering Utricularia, other interesting Utricularia species, Nepenthes mirabilis, N. maxima, Mexican Pinguiculas, Sarracina alata, S. oreophila, Drosera prolifera, D. regia, Genlisea, carnivorous fungi, live sphagnum moss.

John Graham, 8 Waruda St., Bracken Ridge, 4017, Queensland, AUSTRALIA. (WB) Seed only of the following: D. cuneifolia, D. trinervia, D. villosa, D. madagascarensis, D. sessilifolia, D. regia, D. binata extrema, D. petiolaris, P. caudata, P. gypsicola, U. sandersoni, U. pubescens, U. prehensilis and U. racemosa.

Andre Horvath, 60 Pringle Ave., Belrose, NSW 2085, AUSTRALIA. (WT) Australian CPs for Utricularia, Pinguicula, Heliamphora, Darlingtonia and Drosera.

Leo Ohtakay, 3905 Skycrest Dr., Pasadena, CA 91107. (W) The following plants free or reasonably priced: Nepenthes khasiana, N. x dicksoniana, N. mirabilis, Cephalotus follicularis.

Steve Smith RD #1, Box 296, Kirkwood, NY 13795. (WTB) D. schizandra, D. adelae, D. regia, Heliamphora (any), P. gypsicola, P. caudata, D. trinerva, D. villosa. (T) N. rafflesiana, N. hookeriana cuttings.

## REVIEW OF RECENT LITERATURE (cont)

with nematode trapping. It is postulated that the rapidly swelling cells of constricting rings which effect trapping of nematodes as they pass through, is due to generated gases rather than fluid shift.

Windler, DR. 1979. A water plant with a taste for tiny beasts. Smithsonian 10: 91-94. (Photos by Robert Noonan).

A moderately informative popular article on U.S. Utricularias (for those who know nothing about them), but with five interesting color photos, four of these featuring unique lighting and magnification features. DES

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*Sarracenia flava* in habitat near Crestview, Florida just off I-10. Note the heavy veination on the tube with none on the lid and the prominent throat patch.

Photo by J. Miller

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